

boiled down to 45° Baume. After being cooled the mass is agitated, and the result is a fine, white, and dry crystalline sugar.

The continuous air-current used by me hastens the mashing of the flour and makes the disintegration of the starch granules more complete and thorough. It quickens the conversion of the starch into sugar in the process of boiling, and assists the neutralization of the acid. It increases the facility with which the liquor can be cooled during the manipulations. It prevents through all the operations the coloring or burning of the liquor, and materially assists to make a purer and sweeter sirup, and one which can be crystallized into a dry sugar. If the mass is sufficiently light, the air-current alone will serve to agitate the same, and the stirrers can be dispensed with.

PROCESS OF MANUFACTURING GLUCOSE.

PATENTED BY CLINTON FURBISH, OF BROOKLYN, N. Y., APRIL 13, 1880.

The object of the invention is to reduce the cost of manufacturing glucose or sweet liquor from corn, and to produce an article of superior quality, which, when made by the use of diastase, may be practically free from oily matters and from unconverted starchy matters; and it consists of a compound process, the first step of which consists of pearling the grain, or the reduction of the kernels by a dry clipping and cracking treatment, by which the hulls and heart of the kernels are separated from the hard starchy portions; and, second, the reduction of these starchy portions to a soft pulpy mass; and, third, the conversion of the starchy matters of this mass into glucose or sweet liquor; and in order that my invention may be fully understood I will proceed to describe the manner in which I have practiced it with success.

The Indian corn (shelled from the ear and winnowed) is subjected to the action of a cracking and hulling machine, such, for example, as is used in the manufacture of hominy. By the action of this machine the kernels of corn are hulled, clipped, and cracked, and the hulls and fine-clipped portions are separated from the harder portions of the grain. The hulls and fine-clipped portions contain the bulk of the woody fiber and oily and albuminous matters of the corn, each of which may be separated, if desired, by a proper arrangement of bolts. The harder portions of the grain so obtained, containing the bulk of the starchy matters of the corn, are then placed in a close vessel or tank with water, and subjected to the effect of heat and pressure, by which means the mass is reduced to a pulpy state, and the starchy matters of the purified granular portions of the corn rendered peculiarly susceptible to the action of either diastase or acid for conversion into sweet liquor.

If acid is to be used, I prepare a suitable vessel or tank capable of holding the required pressure and provided with steam heating pipes. In this tank or vessel I place the diluted acid, and by connecting it with the first described tank am enabled by pressure to transfer the contents of the first to the second, and then by closing the second tank to proceed with the conversion by heat and pressure by the well-known and often described process.

If diastase is to be used, I discharge the pulpy mass from the vessel or tank into an open tank or vessel provided with a coil for heating and cooling and with a suitable stirrer or stirrers. By means of water running through the coil while stirring is continued I reduce the mass to a temperature of about 120° Fahrenheit, when I add a solution of barley-malt at a temperature of about 100° Fahrenheit, in the proportion of eight pounds of dry malt for every hundred pounds of dry corn treated as above described in the first step of my compound process; and I have found it best in practice to use in the vessel or tank in which the purified starchy portions of the corn are subjected to pressure about fifty gallons of soft water for every one hundred pounds of such dry starchy portions of the corn. After adding the solution of malt above described I gradually raise the temperature of the mass by passing steam through the coils, while stirring is continued until the mass attains a temperature of about 155° Fahrenheit, and I have obtained the best results by raising the temperature at the rate of 1° Fahrenheit per minute. When, by testing, either by iodine, alcohol, or by a saccharometer, I find the starchy matters of the corn thoroughly converted, I draw off the liquor, separating it from the solid residuum either by means of a filter-press, or by means of the action of a properly arranged centrifugal machine, or by any other suitable device. The liquor may then be filtered through bone filters and concentrated to the proper gravity required for sale, or it may be used unfiltered in the manufacture of malt liquors, alcohol, or vinegar, as may be desired. The sweet liquor so produced will be found practically free from starchy matters, and on this account peculiarly adapted for the manufacture of malt liquors.

The process as above described is not restricted to the use of a particular kind or exact quantity of malt, as rye-malt may be used for the purpose, and the quantity of malt may be varied as circumstances render expedient. Nor is the process restricted to the maintenance of the heat at the exact temperatures named, as these may be varied without materially changing the result.

IMPROVEMENT IN THE MANUFACTURE OF GLUCOSE.

PATENTED BY NARCISSE PIGEON, OF BROOKLYN, N. Y., MAY 21, 1878.

The object of the process, taken as a whole, is to obtain the maximum quantity of grape-sugar and the minimum quantity of dextrine from a given quantity of corn or starch, and at the same time to obtain economically, in the process of manufacture, the largest possible amount of extract or saccharine matter.

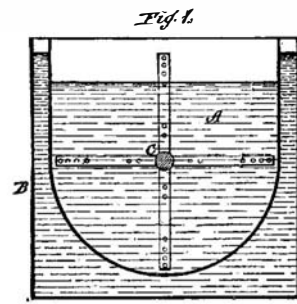
The first step of the process is to add a certain quantity of diastase to the corn-mash, either previously to heating or before the temperature has reached 125° Fahrenheit, chiefly to prevent thickening of the mash by its chemical action on the starchy and gummy matter, thereby promoting subsequent exfoliation. In other words, the diastase keeps the mash as thin and liquid as possible, and in better condition for ultimate conversion into saccharine matter. After diastase has been added the mash is heated, by use of a water-bath, up to 185° Fahrenheit, at which temperature the vegetable albumen begins to coagulate. The mash is then allowed to cool to 152° Fahrenheit, when another quantity of diastase is added, for the purpose of effecting perfect conversion of the starchy matter.

I show in accompanying drawings a vertical section, Fig. 1, and plan view, Fig. 2, of a water bath and mash agitator which I employ in carrying out my process.

The process itself is as follows. The quantity of Indian corn or maize to be treated is reduced to meal by the ordinary grinding operation. The inner chamber, A, of the water-bath, B, is then filled with the requisite quantity of water. After the water has been heated up to about 120° or 125° Fahrenheit, the requisite quantity of meal is introduced and mixed with it. I then immediately introduce a portion of the aggregate quantity of malt I employ in the process.

The proportions, by weight, of water, meal, and malt are as follows, to wit: Water, four hundred to eight hundred parts; meal, one hundred parts; malt, fifteen parts—that is to say, the quantity of water may be varied according to the desired sweetness or consistency of the sirup or wort to be produced; and in the first stage of the process above described, the proportion of malt used is five parts or pounds, the remaining ten parts being reserved for use in the second or last stage of the process, as hereinafter described.

At once the malt has been added to the mash, agitation of the latter is begun by means of the armed shaft, C, and it is also heated gradually up to about 185° Fahrenheit, not, however, by direct application of heat, but indirectly by raising the temperature of water-bath, A, to 195° Fahrenheit, beyond which degree it should never be carried. The mash is next cooled to 152° Fahrenheit, either naturally or by introduction of cold water into the water-bath, and continued agitation. I then add the residue of the malt, to wit, ten parts (or more), by weight, to one hundred parts of the meal, and keep up the agitation for one-half hour, the bath being at the same time kept covered. The mash is next allowed to stand one half hour, and again agitated a few minutes. It then stands another hour for the purpose of facilitating saccharization. During

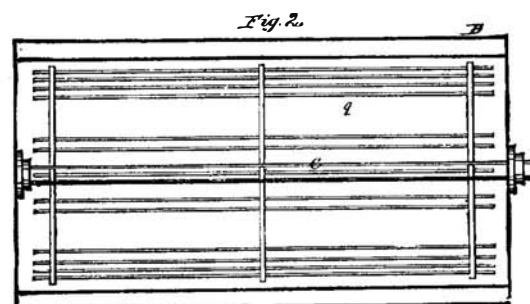


all this time the mash is maintained at 152° Fahrenheit, or thereabout. After the mash has been thus alternately agitated and allowed to stand quiescent, its temperature is raised to 172° or 175° Fahrenheit by raising the heat of the water in the jacket of the water-bath. After the degree of 172° or 175° Fahrenheit has been reached, steam is utilized for raising the temperature to 185° Fahrenheit, or even 190° Fahrenheit.

Throughout the process the temperature of the mash is never raised above 185° Fahrenheit, and hence the water in the jacket, B, is never raised above 195° Fahrenheit, or thereabout, this being the indispensable condition of the desired measure of success, since a degree of heat above 185° Fahrenheit will coagulate the vegetable albumen. It is equally indispensable that the mash shall not be subjected to steam heat or equivalent while its temperature is below 172° or 175° Fahrenheit; but when it has reached that point, it is then safe and practicable to employ steam-heat, which is, however, done only to save time, by quickly raising the mash to 185° Fahrenheit.

The steam-heat may be applied by means of a coil of steam-pipe in the chamber, A, of the water-bath, or directly to the water-bath, B.

By means of the water-bath the heat is applied gently, and gradually increased to the required degree, so that the albumen of the grain particles is not coagulated, as it would be if a high heat were applied. Such coagulation will prevent rupture of the starch cells and the desired exfoliation, and, since exfoliation is the necessary precedent of sacchari-



zation, it results that when such coagulation takes place the ultimate effect will be the extraction of but a small per cent. of saccharine matter. The most important condition of success is, however, the fractioning of the malt—that is to say, its application in the first stage of the process, and also in the second or last stage. By adding the malt to the mash in small quantity at first and a larger quantity subsequently, it produces a widely different effect than when applied all at one time.

By my process it is practicable to obtain at least seventeen per cent. of dry extract or saccharine matter.

After the completion of the process as above described, I filter the liquor through a mash tun having a false bottom, arranged as charcoal filters are in sugar refineries, and spray the residuum with hot water for complete extraction. The sirup or sweet liquor thus obtained is then evaporated in vacuum pan to the desired consistency for use as wort. For table use, I concentrate the liquor in a vacuum pan to 20° to 30° Baume; then defecate with blood or other means; next filter through bag-filter and through bone-black, as practiced in sugar refineries. The sirup thus produced I concentrate to 40° or 42° Baume, and mix it with an equal quantity of cane-sugar sirup.

PHOSPHORESCENT LAMP FOR MINERS.

The latest and not the least promising application of luminous paint is in the production of a safety lamp for coal miners. It is said to give light enough for practical use, and it is obvious that, in containing no fire, it is absolutely free from risk. By this invention, in connection with compressed-air blasting, fire and the attendant danger of exploding fire damp might be ruled out and the most dangerous mines made comparatively safe.

DETECTION OF THE COAL-TAR COLORS.

The following paper was read by Mr. J. Spiller, F.C.S., before the Chemical Section of the British Association at the Swansea meeting, August, 1880

Dyers and others who are in the habit of using the coal-tar colors are familiar with a number of chemical reactions by which the members of the series may generally be classified and identified. Differences are remarked in their relative affinities for various sorts of fibers, some colors being taken up freely by silk, others fixing better upon wool, and some few, like saffranine, exhibiting a special affinity for cotton.

Again, as with the yellow, great differences are observed when the operator proceeds to work with a free acid or a weak alkali in the dye bath, primrose (naphthaline yellow) requiring the former, but not so with phosphine (chrysaniline yellow), which requires a neutral, or even slightly alkaline bath.

By the study of these conditions, aided by a few characteristic tests, it is often possible to identify coloring matters of unknown or doubtful origin, and it is with the view of extending the number of such readily available tests that I recommend a more frequent appeal to the color reactions with sulphuric acid.

For this purpose but small quantities of material are required, a few grains serving to impart a distinct color to a comparatively large bulk of sulphuric acid, and the resulting indications are in many cases both specific and permanent.

Oil of vitriol, which so readily destroys nearly all organic substances, does not carbonize any of the coal tar colors, or does so only under severe conditions, as at high degrees of heat. Even indigo and madder, though of true vegetable origin, are known to yield up their coloring matters to sulphuric acid, the old processes of dyeing depending upon this fact. In the manufacture of garancine from madder the woody fiber and organized tissues are destroyed by the action of sulphuric acid, while the alizarine glucoside survives, and with it Turkey-red goods may be dyed. Instances might be multiplied that coloring matters, both natural and artificial, resist the attack of oil of vitriol, and the large class of sulphonates (Nicholson blue, 'acid roseine,' etc.), may be cited as establishing the fact that coloring matters are not so destroyed, but form combinations with sulphuric acid.

If, then, the body under examination be dissolved in strong oil of vitriol, a color test is at hand whereby useful inferences may be drawn as to the nature of the dye, and often its exact identity disclosed. A few direct confirmatory tests may then be applied. The most remarkable color reactions are the following:

Magdala (naphthaline pink) . . .	Blue black.
Saffranine	Grass green, turning indigo blue if strongly heated.
Chrysoidine	Deep orange, turning almost scarlet on heating.
Alizarine	Ruby red or maroon.
Eosine	Golden yellow.
Primrose (naphthaline yellow) . .	Springly soluble, first yellow color discharged on heating.
Chrysaniline	Yellow or brown solution fluorescent.
Aurine	Yellowish brown; not fluorescent.
Atlas orange	Rose; turns scarlet on heating.
Atlas scarlet	Scarlet solution, permanent on heating.
Biebrich scarlet R	Blue black or deep purple.
Biebrich scarlet B	Bluish green.
Aniline scarlet	Golden yellow; permanent on heating.
Induline	Slate blue to indigo.
Rosaniline, regina, and all violets	Yellow or brownish yellow.
Phenyl and diphenylamine blues	Dark brown solutions.
Iodine green	Bright yellow solutions, the former giving off iodine on heating.
Malachite green	
Citronine	Pale cinnamon or neutral tint.

After oil of vitriol the action of concentrated muriatic acid may next be tried, which distinguishes at once between saffranine and Biebrich scarlet, the former giving a violet solution and the latter being precipitated as a red flocculent powder.

Proceeding in this way, and combining the observation with the dyer's usual tests, every one of the substances named can be readily identified, and much time saved in the examination of dyewares.

COLORS IN PATTERNS.

In the colored branches of fancy cassimeres, the distribution or arrangement of colors in a pattern is of no less importance than the choice of weave to apply to it, and any person who has the least experience in the arrangement of colors in patterns will perceive that some colors will have more brilliancy and effect when placed together than when they are placed separate or beside some others.

This arises neither from taste nor imagination, but is founded in nature, and may be explained on the principles of optics, for it is well known that the seven prismatic colors have exactly the same relation to each other as the notes in an octave in music, and therefore the effect produced by artfully disposing of the kindred colors is no less pleasing to the eye than the concords of musical sounds are grateful to the ear.

Colors, therefore, with respect to the effect which they thus produce, may be arranged under two heads—namely, those which are contrasting, and those which are harmonizing. The contrasting colors are such as are most opposed to each other; the harmonizing colors are those intermediate tints which lie between the contrasting ones, and, as it were, blend them together.

The contrasting colors may be discovered by a very simple optical experiment. Place, for example, a red wafer on a sheet of white paper, and look on it steadily for some time until the eye becomes tired, and a ring of green will begin to appear round its edge; and even after the eye has been removed to another part of the paper, the green ring will